

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY



(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference A0004/PCT		FOR FURTHER ACTION See Form PCT/IPEA416	
International application No. PCT/EP2004/051439		International filing date (day/month/year) 09.07.2004	Priority date (day/month/year) 28.07.2003
International Patent Classification (IPC) or national classification and IPC C08C19/02			
Applicant KRATON POLYMERS RESEARCH B.V.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau) a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 19.01.2005		Date of completion of this report 04.11.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer Denis, C Telephone No. +31 70 340-3599 	

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/051439

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-19 as originally filed

Claims, Numbers

1-10 as originally filed

Drawings, Sheets

1 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/051439

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	1-10
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Item V

Reference is made to the following documents:

- D1: US-A-5 705 571 (TSIANG RAYMOND CHIEN-CHAO ET AL) 6 January 1998
- D2: US-A-3 673 281 (BRONSTERT KLAUS ET AL) 27 June 1972
- D3: WO 02/16449 A (KRATON POLYMERS RES B V ;JONG WOUTER DE (NL);
SCHISLA DAVID K (NL)) 28 February 2002
- D4: US-A-4 595 749 (HOXMEIER RONALD J) 17 June 1986

1) With regard to documents D1 to D4 the subject-matter of claims 1 to 10 of the present application is novel in the sense of Article 33(2) PCT.

Document D1 discloses a specific hydrogenation catalyst combination including a substituted or unsubstituted bis(cyclopentadienyl) Group VIII and buthyl lithium (column 2 lines 36 to 50 and column 4 lines 10 to 15). The comparative example 4 refers to the selective hydrogenation of a block copolymer terminated with phenyl benzoate and comprising 43% of vinyl bonds. The hydrogenation is performed with Ni octoate and AlR_3 and results in a polymer having a content of 1,4-bond of 42% and a lower vinyl content of 3%. D1 differs from claims 1 to 10 in that the catalyst used does not contain iron.

Document D2 describes the selective hydrogenation of block polymers containing double bonds by a complex of Fe, Co or Ni compounds, an organic aluminium derivative and a hexaalkylphosphotriamide as activator (column 1 lines 34 to 45 and column 3 lines 18 to 27). Tests carried out in examples 5 and 6 shows that hydrogenation is slower with iron when compared to cobalt and nickel and that it is possible to obtain selective hydrogenation of vinyl bonds only with cobalt catalyst. Document D2 differs from the present application in that the block polymer before hydrogenation contains only 10% of vinyl bonds.

Document D3 refers to the preparation of terminated block copolymers obtained by terminating the living chain ends with a member from the group consisting of an alcohol or hydrogen (page 2 lines 27 to 37). The terminated block copolymers are then contacted with hydrogen in the presence of a catalyst prepared by combining a cobalt carboxylate with an aluminum alkyl (example 5). D3 differs from claims 1 to 10 in that the

hydrogenation catalyst does not contain iron.

Document D4 discloses a method for separating metal catalyst contaminants from organic polymers, typically block polymers derived from dienes and/or vinyl arenes, by treatment with a dicarboxylic acid such as nonanedioic acid and eventually an oxidant (column 3 lines 11 to 20 and column 4 lines 50 to 65). The presence of an oxidant is not critical for the separation process (column 5 line 17). This process suits particularly block polymers being subjected to hydrogenation reaction and contaminated with catalyst residues such as iron or nickel (column 3 lines 34 to 39).

D4 differs from claims 1 to 10 of the present application in that the hydrogenation step of the block polymers is not inclosed.

2) The subject-matter of claims 1 to 10 of the present application complies with the requirements of Article 33(3) PCT:

Document D1 which is considered to represent the closest prior art discloses the selective hydrogenation of a block copolymer terminated with phenyl benzoate and comprising 43% of vinyl bonds and carried out in presence of a catalyst comprising Ni octoate and AlR_3 (comparative example 4).

Claims 1 to 10 of the present application differ from document D1 in that the hydrogenation catalyst is based on iron.

Examples 1 to 3 on file show that this distinguishing technical feature lead to an improved selectivity of the hydrogenation process: the vinyl bonds are reduced to a level of 5% or less whereas the content of 1,4-linkages remains above 30%.

The objective problem of the present application to be solved may therefore be regarded as to provide an improved method for selectively hydrogenating the vinyl bonds of block copolymers.

The solution to this problem is the use of an iron based catalyst. The solution proposed in claim 1 of the present application can be considered as involving an inventive step for the following reasons:

In document D2, experiments carried out in table 1 show that 1,2-portions (of the SBS block polymer) can selectively be hydrogenated (0% in the semi-hydrogenated state) while the content of 1,4-portions are present at a level of 50%. However, this result is possible in

the presence of a **cobalt** based catalyst.

Other experiments (see example 6, table 3) involve the use of an **iron** based catalyst.

These experiments are focussing on the *kinetic aspect* of the hydrogenation reaction when compared to **cobalt** or **nickel** based hydrogenation catalysts. The semi-hydrogenated state is achieved after 14 hours with the iron based catalyst, only 1 hour with the catalyst containing cobalt. However, these data concern only the kinetic aspect of the reaction. No conclusion may be drawn from this example concerning the selectivity of the hydrogenation process involving an iron based catalyst.

Starting from D1 and seeking to provide an improved method for selectively hydrogenating the vinyl bonds of block copolymers, the skilled man would not have an incentive in D2 to use an iron based catalyst for the hydrogenation step.

Claims 1 to 10 are therefore inventive.